

Subject card

Subject name and code	Options theory, PG_00155475						
Field of study	Mathematics						
Date of commencement of studies	October 2025	Academic year of realisation of subject			2026/2027		
Education level	Master's studies	Subject group			Obligatory subject group in the field of study		
Mode of study	full-time studies	Mode of delivery			at the university		
Year of study	2	Language of instruction			Polish		
Semester of study	4	ECTS credits			6.0		
Learning profile	academic	Assessment form			exam		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr Monika Wrzosek				
	Teachers		dr Monika Wrzosek				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	60		10.0		80.0	150
Subject objectives	To familiarize students with classical option pricing models and directions of their generalizations.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[MATMU2_U07] is able to define his/her interests and develop them; in particular, is able to establish contact with specialists in his/her field, e.g. understand their lectures intended for young mathematicians		
	[MATMU2_W03] knows and understands in-depth a selected field of theoretical or applied mathematics and is able to understand the formulations of issues in this field that are still at the research stage and knows the connections of issues in this field with other areas of mathematics		
	[MATMU2_U04] is able, at an advanced level and including modern mathematics, to apply and present, orally and in writing, methods of at least one selected branch of mathematics	The student is able to solve problems in options theory using various probabilistic methods.	[SU4] test/exam - oral or written
	[MATMU2_K06] is ready to formulate opinions on basic mathematical issues	The student is able to formulate opinions on basic issues of property insurance.	[SK1] oral statement/conversation/discussion
	[MATMU2_U06] is able to apply methods and examples from a selected field of mathematics in related fields	The student is able to construct models of problems in the field of options theory.	[SU4] test/exam - oral or written
	[MATMU2_K01] is willing to acknowledge the limitations of his or her own knowledge and is willing to pursue further education	The student understands the limitations of his or her own knowledge and the need for lifelong learning.	[SK8] observation of student's independent or team work
	[MATMU2_U01] can construct mathematical reasoning: prove theorems and refute hypotheses through construction and selection of counterexamples	The student is able to prove selected theorems in options theory.	[SU4] test/exam - oral or written
	[MATMU2_K02] is ready to precisely formulate questions to deepen his/her understanding of a given topic or find missing elements of reasoning	The student is ready to formulate questions to deepen understanding of a given topic.	[SK8] observation of student's independent or team work
	[MATMU2_K04] is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; ethical conduct	The student understands and appreciates the importance of intellectual honesty and ethical conduct.	[SK8] observation of student's independent or team work
	[MATMU2_W02] knows and understands well the role and importance of the construction of mathematical reasoning	The student knows and understands proofs of theorems and understands the role of reasoning construction in options theory.	[SW4] test/exam - oral or written
	[MATMU2_K05] is ready to independently search for information in literature, also in foreign languages	The student is ready to search for information in scientific studies.	[SK8] observation of student's independent or team work
	[MATMU2_W01] knows and understands in-depth the theory of selected areas of mathematics	The student knows and understands options theory and the role that probabilistic methods play in it.	[SW4] test/exam - oral or written
	[MATMU2_U05] can perform proofs in a selected field and, if necessary, also use tools from other areas of mathematics	The student is able to prove selected theorems in the field of options theory.	[SU4] test/exam - oral or written
	[MATMU2_U03] can understand mathematical texts of various types from selected fields of mathematics	The student is able to prove selected theorems in options theory.	[SU4] test/exam - oral or written
Subject contents	1. Discrete-time financial market model. - portfolio, portfolio value, self-financing strategies, - arbitrage and martingale measure, - European payoff, replicating strategies, complete market, - martingale method of derivatives valuation, - Cox-Ross-Rubinstein binomial model. 2. Continuous-time financial market model. - Black-Scholes model, martingale valuation of derivatives, - valuation of European options in the Black-Scholes model, 3. Option sensitivity coefficients. 4. American, exotic options. 5. Historical method and implied volatility method of determining the volatility coefficient σ (volatility), 6. Review of models that are generalizations of the B-S model, in particular the Hull and White, Heston, or Dupire models.		

Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	exam	51.0%	65.0%
	tests	51.0%	35.0%
	observation of the student's attitude	51.0%	0.0%
Recommended reading	Basic literature	1. J. Jakubowski, Modelowanie rynków finansowych, Script, 2006. 2. J. Jakubowski, A. Palczewski, M. Rutkowski, Ł. Stettner, Matematyka finansowa. Instrumenty pochodne, WNT, 2003. 3. S. R. Pliska, Introduction to Mathematical Finance, Discret Time Models, Blackwell Publishers, 1997. 4. J. Hull, Kontrakty terminowe i opcje. Wprowadzenie. WIG - Press, Warszawa 1997. 5. D. Lamberton, B. Lapeyre, Introduction to Stochastic calculus applied to finance, Chapman and Hall, 1996. 6. M. Musiela, M. Rutkowski, Martingale Methods in Financial Modelling, Springer, 1997. 7. A. Weron, R. Weron, Inżynieria Finansowa, WNT, 1999.	
	Supplementary literature	none	
	eResources addresses		
Example issues/ example questions/ tasks being completed	not included		
Work placement	Not applicable		

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